IN THE DRAWING

The next following Replacement Sheets label Figs. 3 - 7 Prior Art, as requested. These Replacement Sheets are not to be confused with the last-appended Reference Figures 1 - 7.

## REMARKS

The objection to the drawing is attended to above.

The rejection of retained claims 1 and 3 under 35 USC 102 for anticipation by the admitted prior art of the specification, and as the same may be applied to new claim 5 that corresponds to claim 1, is traversed. The traversal can be better understood by first understanding the problems of the admitted prior art solved by the claimed invention.

The invention disclosed in the cited reference JP Patent Publication No. 3278797 (which is the applicants) is the admitted cited in the specification. However, there also existed art before the invention disclosed in the Patent Publication No. 3278797, that being the rotary nozzle having the "oval" planar fixed plate brick and slide plate brick, disclosed in the Patent Publication No. 3278797.

Therefore, the admitted prior art is:

1) Conventional Art disclosed in the Patent Publication No. 3278797 (oval planar shape);

2) Invention disclosed in the Patent Publication No. 3278797 (substantially egg-form planar shape); and

3) Invention of the present application (substantially elliptical planar shape).

And the problems to be solved are briefly as follows:

1) → 2) Reduce the surface areas of the fixed plate brick and the slide plate brick (in terms of the economic effect); and

2) → 3) Make the substantially egg-form planar shapes of the fixed plate brick and the slide plate brick, which may result in leakage of molten steel, the planar shapes capable of solving this problem while maintaining the economic effect.

That is to say, with the oval planar shape in the art 1), the molten steel certainly hardly leaked, however, the surface areas of the fixed plate brick and the slide plate brick were unnecessarily large and problematic in cost, so that the surface areas thereof were reduced by making the planar shapes of the fixed plate brick and the slide plate brick substantially egg-form (Patent No. 3278797). This produced significant economic effect, however, there exists portion from which the molten steel may leak because of the too small planar shapes. Therefore, an object of the invention of the present application is to increase the surface areas at minimum at these portions so as to prevent the molten steel from leaking.

Therefore, the challenges of the present invention were to find the ideal planar shapes of the fixed plate brick and the slide plate brick, by solving the risk of the molten steel leakage, which was the weak point of the invention disclosed in the Patent No. 3278797, while sufficiently maintaining the effect of the invention disclosed in the Patent No. 3278797, which provides the economic effect in cost by reducing the planar shape from the oval shape. Accordingly, this is not to solve the problem of ambiguous level such as "to make the planar shape sufficiently securing the safety margin when rotating" (if it is wanted "to make the planar shape sufficiently securing the safety margin when rotating", it is only necessary to

return to the conventional art disclosed in the Patent Publication No. 3278797, that is to say, the oval planar shape).

To meet these challenges, as the side shape of the invention of the present application is derived from the foregoing, it becomes clear that the object of the invention of the present application is to solve the two conflicting problems, which are economic reasonability (reduction of the planar shape) and prevention of molten steel leakage (enlargement of the planar shape).

Next, it will be described in detail how the above-described problems are specifically solved in the invention of the present application.

As is clear from the Reference Figures 1 and 2 attached, in the invention of the present application, the outer shape protrudes in a range in which the crossing angle between the fixed plate brick and the slide plate brick is from 0° to 70°, from the basic planar shape of the invention disclosed in the Patent Publication No. 3278797 (hereinafter, referred to as the "invention disclosed in the cited reference 1").

The planar shape shown in the Reference Figures 1 and 2 is the planar shape of the fixed plate brick and the slide plate brick of the normal size in which D (diameter of the nozzle holes 4 and 5) is 45 mm, C (distance from the center X of the planar shape to the center Y of the nozzle holes 4 and 5) is 70 mm, B1 (safety margin at the time of the full-opened state of the nozzle holes 4 and 5 and the crossing angle between the fixed plate brick and the slide plate brick is 0°) is 47.5 mm and A1 (safety margin at the time of the full-closed state of the nozzle holes 4 and 5 and the crossing angle between the fixed plate brick and the slide plate brick is 90°) is 23.5 mm. The planar shapes of the fixed plate brick and the slide plate brick of the conventional art (oval) disclosed in the Patent Publication No.

3278797 and those of the invention (substantially egg-form) disclosed in the Patent Publication No. 3278797 are drawn so as to correspond to the those of the Reference Figures 1 and 2. Meanwhile, the angle of the second circular portions H1 q is 40°.

In the Reference Figures 1 and 2, the outer shape a (solid line) represents the outer shape (substantially elliptical shape) of the fixed plate brick and the slide plate brick of the invention of the present application, the outer shape b (solid line in gray) represents the outer shape (substantially egg-form) of the fixed plate brick and the slide plate brick of the invention disclosed in the cited reference 1, and the outer shape g (broken line in gray) represents the outer shape (oval) of the fixed plate brick and the slide plate brick of the conventional art disclosed in the Patent Publication No. 3278797.

In the Reference Figure 2, the variation in the angle between the fixed plate brick and the slide plate brick is illustrated by the representative positions as follows. The nozzle hole 4 is that of the fixed plate brick and is in the fixed state, and the nozzle hole 5 is that of the slide plate brick and rotates around X.

<Position 1> When the angle between the fixed plate brick and the slide plate brick is 0°. The nozzle holes 4 and 5 entirely overlap (full-opened state).

<Position 2> When the angle between the fixed plate brick and the slide plate brick is 20°. The nozzle holes 4 and 5 deviate from each other by substantially half (half-opened state). The opening degree already is a little over one-third.

<Position 3> When the angle between the fixed plate brick and the slide plate brick is 40°. The nozzle holes 4 and 5 become in full-closed state substantially from this angle.

<Position 4> When the angle between the fixed plate brick and the slide plate brick is 70°. The nozzle holes 4 and 5 are in full-closed state.

<Position 5> When the angle between the fixed plate brick and the slide plate brick is 90°. The nozzle holes 4 and 5 are in full-closed state.

Next, in the above-described five positions, the actually measured variation of the minimum distance from the end of the nozzle hole 5 to the outer shapes a and b of the fixed plate brick is as follows, in which an represents the minimum distance (safety margin) from the end of the nozzle hole 5 to the outer shape a in the invention of the present application, and bn represents the minimum distance (safety margin) from the end of the nozzle hole to the outer shape b in the invention disclosed in the cited reference 1.

<Position 1> a1=47.5 mm, b1=47.5 mm, a1=b1=B1 (safety margin at the time of the full-opened state of the nozzle hole in the invention of the present application)

<Position 2> a2=47.5 mm, b2=32.5 mm, b2/a2=68.4%, a2/b2=146.2%

<Position 3> a3=32.5 mm, b3=22.5 mm, b3/a3=69.2%, a3/b3=144.2%

<Position 4> a4=23.5 mm, b4=23.5 mm, a4=b4=A1 (safety margin at the time of the full-closed state of the nozzle hole in the invention of the present application and the angle between the fixed plate brick and the slide plate brick is 90°)

<Position 5> a5=23.5 mm, b5=23.5 mm, a5=b5=A1 (safety margin at the time of the full-closed state of the nozzle hole in the invention of the present application and the angle between the fixed plate brick and the slide plate brick is 90°)

Hereinafter, the state of the molten steel flow in the above-described five positions will be discussed in detail, and Fig. 4 of the Patent Publication No. 3278797 should be noted here. That is to say, Fig. 4 of the Patent Publication No. 3278797 illustrates the meltdown-damaged state of the slide plate brick, and illustrates that the meltdown-damage progresses from the nozzle hole to the rear end in rotational direction.

When the slide plate brick is new, the meltdown-damage state is naturally out of account, however, as the meltdown-damage of the slide plate brick progresses as shown in Fig. 4 of the Patent Publication No. 3278797, the molten steel leaks over the meltdown-damaged portion, naturally, so that the planar shapes of the fixed plate brick and the slide plate brick should be considered with the molten steel leakage taken into account.

The Reference Figure 3 shows the relationship between the nozzle holes 4 and 5 at the position 1 (0°) with the meltdown-damaged state taken into account. On the 0° line, the outer shapes $\alpha$ (the invention of the present application), $\beta$ (the invention disclosed in the cited reference 1) and $\gamma$ (oval) are identical and equal to B1, and a1=b1=47.5 mm, however, looking at the hard meltdown-damaged portion of the slide plate brick, although the outer shape $\alpha$ is at the substantially same distance as the outer shape $\gamma$ (a0=a1=47.5 mm), the outer shape $\beta$ is already largely reduced to be b0=34.5 mm, and the difference between a0 and b0 is 13 mm.

Next, when the slide plate brick rotates by 20°, this reaches the position 2 (refer to Reference Figure 4). In this state, a2 is 47.5 mm (=a1=B1), however, b2 is reduced to 32.5 mm, so that there is the difference of 15 mm. b2 is 68.4% of a2, and a2 is 146.2% of b2.

At the position 2, the nozzles 4 and 5 are in the half-opened state in which they deviate by as much as substantially radius from each other, and the opening degree is areally a little more than one-third of the full-opened state. If the slide plate brick is new, the molten steel flow volume is limited to a little more than one-third, however, if the meltdown-damage of the slide plate brick progresses, the molten steel flow volume becomes larger than this.

The reason thereof is that the hard meltdown-damaged portion of the slide plate brick just overlaps the nozzle 4, as clearly shown in reference drawing 4, so that this portion is not

fully closed and the molten steel leaks over the hard meltdown-damaged portion to the nozzle hole 5, then the molten steel flow volume from the nozzle 5 increases.

Herein, the difference between the safety margins a2 and b2 becomes problematic. Since the safety margin b2 of the outer shape β (the invention disclosed in the cited reference 1) is designed without taking the progress of the meltdown-damage of the slide plate brick into account (targeted to the new brick), when the meltdown-damage of the slide plate brick progresses and the molten steel flow volume of the nozzle 5 increases, the molten steel may leak. However, since the safety margin a2 (the invention of the present application) secures the safety margin as large as the safety margin a1 at the position 1 even at this position, this may deal with the increase in molten steel flow volume. That is to say, this is the reason why the second circular portions H1 are drawn around the center X.

Theoretically, even though the molten steel flow volume from the nozzle hole 5 is as much as in the full-opened state, this is resistible. That is to say, since the third circular portions K is the curved line drawn around the center Y=Z of the nozzle hole 4 in the Reference Figure 4, the minimum safety margin a2 (=B1) is secured in all directions from the end of the nozzle hole 4, as shown in the Reference Figure 4. Herein, the reason of drawing the third circular portions K is clear.

Next, when the slide plate brick further rotates by 20° (rotates totally by 40°), this reaches the state of the position 3 in the Reference Figure 5. Since the overlap of the nozzle holes 4 and 5 fully disappears at this position, the safety margin may be theoretically the same safety margin of the state at the position 4 (Reference Figure 6) in which the slide plate brick further rotates, and further at the position 5 (Reference Figure 2), that is to say A1 (=23.5 mm). In fact, the safety margin b3 of the outer shape β (the invention disclosed in the cited

reference 1) is 22.5 mm, which substantially identical to A1.

However, when the meltdown-damage of the slide plate brick progresses, since the hard meltdown-damaged portion still largely overlaps the nozzle hole 4, as is clearly shown in the Reference Figure 5, the molten steel flows over there to the nozzle hole 5, so that this is not fully closed. Therefore, the safety margin is clearly insufficient at A1 in such a state, and this should be made larger.

In the invention of the present application (outer shape α), the safety margin a3 at this position is made 32.5 mm, 144% more than the safety margin b3 (outer shape b). Accordingly, the risk of the molten steel leakage is reduced considerably even in a state in which the meltdown-damage of the slide plate brick progresses at the position 3.

Next, when the slide plate brick further rotates and reaches the position of 70° (position 4), the hard meltdown-damaged portion of the slide plate brick deviates from the nozzle hole 4, as shown in the Reference Figure 6, no molten steel leaks from the nozzle hole 4 to the nozzle hole 5, and is made fully closed state. Therefore, from this portion, the safety margin A1 of the fully closed state is sufficient, and the safety margin larger than this is needless. Therefore, the invention of the present application makes the safety margin from this portion A1 (constant). Therefore, the safety margin a5 at the position 5 (Reference Figure 2) is also A1, naturally.

As is discussed in the foregoing, in the invention of the present application, the outer shape α is created by protruding the outer shape with the first circular portions H1 and the third circular portions K in the zone between 0° and 70° in which the molten steel may leak, so as to prevent the molten steel leakage even when the meltdown-damage of the slide plate brick progresses, from the basic outer shape β disclosed in the cited reference 1. There is also

the theoretical grounding as described above in the drawing of the first and third circular portions H1 and K. Therefore, this invention has the technical content and the concept of which is completely different from the ambiguous technical content in which "the safety margin when rotating is sufficiently secured". That is to say, this invention is not to "sufficiently secure the safety margin" ignoring the economical effect, but to achieve far advanced technical content to "secure the required minimum safety margin" between the conflicting problems to obtain the economic effect and to prevent the molten steel leakage.

Incidentally, in the Reference Figure 7, approximate variation of the safety margin in the three outer shapes, outer shape α (invention of the present application), the outer shape β (invention disclosed in the cited reference 1), and the outer shape γ (Fig. 12 of the cited reference 1) is represented in the graph. From this graph, it is understood that the invention of the present application (outer shape α) appropriately increases the safety margin in the zone between 0° and 70° in which the molten steel may leak, from that of the basic (conventional art) shape (outer shape β) of the invention disclosed in the cited reference 1.

That is to say, as described above, the object of the invention of the present application is to find the ideal neutralizing point of the conflicting requirements of reduction of the surface area of the planar shape to obtain the economic effect and the enlargement of the surface area to prevent the leakage of the molten steel, so that it is beside the question that the outer shape is enlarged without aim so as to be the outer shape of which surface area is unnecessarily large as the outer shape γ, which is near circular. In the invention of the present application, it is important that appropriate minimum outer shape protruding is performed in the zone between 0° and 70° in which the molten steel could leak, and the design of the outer shape a is achieved as a result of totally considering the examination of the

meltdown-damaged state of the slide plate brick, the relation with the actual molten steel leakage, and the economic effect.

As above, it has been described that the planar shapes of the fixed plate brick and the slide plate brick of the invention of the present application are not at all the technical content in the randomly-made design so as to ambiguously "secure the safety margin when rotating", and is created as the optimal planar shape by totally considering the meltdown-damaged state of the slide plate brick, the actual degree of leakage of the molten steel, and the economic effect.

[Reference Figure 1: comparison of outer shapes of three brick bodies]

α outer shape of brick body of the invention of the present application (substantially elliptical shape, solid line)

β outer shape of brick body of the Patent Publication No. 3278797 (substantially egg-form, solid line in gray)

γ outer shape of brick body of the conventional art disclosed in Patent Publication No. 3278797 (oval, broken line in gray)

A1 safety margin at the time of full-closed state

B1 safety margin at the time of full-opened state

C distance between X and Y

D/2 radius of nozzle hole

G first circular portion

H1 second circular portion

J1 tangent line

K third circular portion

[Reference Figure 2: comparison between distances from end of nozzle to outer shape]

$\theta = 40°$ ($\theta$ is range of second circular portion H1 of outer shape of the invention of the present application)

distance (safety margin) a1, b1 a1=b1=B1

position 1 full-open state of nozzle hole 0°

distance (safety margin) a2, a2=B1

position 2 half-open state of nozzle hole (opened substantially one-third already) 20°

distance (safety margin) b2, b2<a2

distance b3 b3<a3

position 3 here, full-closed state of nozzle hole 40°

distance (safety margin) a3

distance (safety margin) a4, b4, a4=b4=A1

position 4 70° full-closed state of nozzle hole

position 5 90° full-closed state of nozzle hole

distance (safety margin) a5, b5, a5=b5=A1

4 nozzle hole (fixed plate brick)

5 nozzle hole (slide plate brick)

position 1

position 2

position 3

position 4

position 5

[Reference Figure 3: relationship between nozzle holes 4 and 5 (position 1)]

hard meltdown-damaged portion of slide plate brick 3

distance (safety margin) b0, a1=b1=B1

distance (safety margin) b0<a0

distance (safety margin) a1=b1=B1

position 1 full-opened state of nozzle hole

nozzle hole 5 (slide plate brick)

θ = 40° (θ is range of second circular portion H1 of outer shape of the invention of the present application)

4 nozzle hole (fixed plate brick)

[Reference Figure 4: relationship between nozzle holes 4 and 5 (position 2)]

θ = 40° (θ is range of second circular portion H1 of outer shape of the invention of the present application)

hard meltdown-damaged portion of slide plate brick 3

position 1 full-opened state of nozzle hole 0°

second circular portion H1

5 nozzle hole (slide plate brick)

position 2 half-opened state of nozzle hole (opened substantially one-third areally) 20°

distance (safety margin) a2, a2=B1

distance (safety margin) b2, b2<a2

K third circular portion

4 nozzle hole (fixed plate brick)

[Reference Figure 5: relationship between nozzle holes 4 and 5 (position 3)]

θ = 40° (θ is range of second circular portion H1 of outer shape of the invention of the present application)

position 1 full-opened state of nozzle hole 0°

hard meltdown-damaged portion of slide plate brick 3

position 2 half-opened state of nozzle hole (opened substantially one-third already) 20°

distance (safety margin) b3, b3<a3

position 3 full-closed state of nozzle hole 40°

distance (safety margin) a3

5 nozzle hole (slide plate brick)

4 nozzle hole (fixed plate brick)

[Reference Figure 6: relationship between nozzle holes 4 and 5 (position 4)]

θ = 40° (θ is range of second circular portion H1 of outer shape of the invention of the present application)

position 1 full-opened state of nozzle hole 0°

position 2 half-opened state of nozzle hole (opened substantially one-third areally) 20°

hard meltdown-damaged portion of slide plate brick 3

position 3 full-closed state of nozzle hole 40°

position 4 full-closed state of nozzle hole 70°

distance (safety margin) a4=b4=A1

4 nozzle hole (fixed plate brick)

5 nozzle hole (slide plate brick)

distance (safety margin) a4=b4=A1

[Reference Figure 7: comparison chart of safety margins of three brick bodies]

minimum distance between end of nozzle hole 5 and outer shape (safety margin (mm))

α outer shape of brick body of the invention of the present application (substantially elliptical shape)

β outer shape of brick body of the Patent Publication No. 3278797 (substantially egg-form)

γ outer shape of brick body of the conventional art disclosed in Patent Publication No. 3278797 (oval)

A1 safety margin at the time of full-closed state

B1 safety margin at the time of full-opened state

zone in which molten steel may leak

angle between fixed plate brick 2 and slide plate brick 3 (°).

Reconsideration and allowance are, therefore, requested.

Respectfully submitted,

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